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ABSTRACT

The purpose of this study was to examine empirically the definition and the relationships of critical reading and critical thinking. The subjects were Hillsborough County, Florida, fifth graders, predominantly of lower and middle class white background. Several tests, including two critical reading tests, and Cornell Critical Thinking Test Form X, the California Test of Mental Maturity, and Metropolitan Achievement Tests were administered in the fall of 1969. Various statistical procedures were performed and the conclusions can be summarized as follows: (1) critical reading does not exist as a separate thinking activity; (2) critical thinking also does not exist as a separate thinking activity; and (3) critical reading and critical thinking insofar as they exist, share a considerable amount of common variance, verbal ability. Full explanation of statistical procedures and correlational tables are included in the document. (See related document CS000103.) (Author/TC)

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CANONICAL AND PARTIAL CORRELATION OF CRITICAL READING - CRITICAL THINKING TEST SCORES - FIFTH GRADE

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ABSTRACT

The objectives of this study were to investigate through first and second order partial correlation and canonical correlation the definitions of critical reading, and critical thinking, and also the relationships between critical reading and critical thinking, reading, language aptitude and achievement. Two critical reading tests, the Intermediate Reading Test - Science, and the Intermediate Reading Test - Social Studies, the Cornell Critical Thinking Test Form X, the California Test of Mental Maturity, and the Metropolitan Achievement Tests were administered to fifth grade pupils. The two critical reading tests correlated moderately high, slightly higher than either the critical reading science test and the critical thinking test, or the critical reading social studies test and the critical thinking test, when language intelligence, and total intelligence, independently, were partialled out. When reading was partialled out the relation between the two critical reading tests held but the correlations involving the critical thinking test were substantially lower. A moderate correlation obtained between the two critical reading tests when both intelligence and reading were removed. When reading was removed from the critical thinking test correlations, they were lowered materially. Part correlations indicated considerable common variance between the two critical reading tests, small to moderate common variance among the two critical reading tests and the critical thinking test, and considerable common variance between the verbal test and the two critical reading tests. The canonical correlations were all in excess of .62 between

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five sets of subtests, literal reading, critical reading, reading, critical thinking, and language and reading and achievement subtests. When the canonical correlations were corrected to assume "perfect" reliability of each set of subtests, the correlation of .80 between the critical reading subtests and the reading and achievement subtests became .91, and the correlation of .81 between the critical thinking subtests and the reading and achievement subtests became .98. It was concluded that neither critical reading nor critical thinking exists as a unique thinking activity, and that critical reading and critical thinking, in so far as they exist, overlap substantially, and that overlap is verbal ability.

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Critical Reading Symposium

CANONICAL AND PARTIAL CORRELATION OF CRITICAL READING - CRITICAL THINKING TEST SCORES - FIFTH GRADE*

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INTRODUCTION

This study is the last in a series of three statistical analyses of critical reading test scores of fifth grade children. This fifth grade data represents half of an overall empirical examination of the definitions of critical reading, and critical thinking, their relationship, and their relationships with critical thinking, intelligence,

*Appreciation is expressed to the Hillsborough County Public School System, and Ballast Point Elementary School in particular for their splendid cooperation.

achievement, and reading. The other half of the overall empirical examination of the definition of critical reading is a series of three analyses of critical reading test scores of similar tests from twelfth grade students.

In the first analysis of the fifth grade data, Follman, Lowe, Johnson, and Bullock (1969) conducted correlational and factor analysis of subtest, and total test scores, independently of:

Intermediate Reading Test-Science (CR SCI) (Maney, 1958) total
- Literal Reading (LR) subtest
- Critical Reading (CR) subtest

Intermediate Reading Test-Social Studies (CR SS) (Sochor, 1958) total
- Literal Reading (LR) subtest
- Critical Reading (CR) subtest

Cornell Critical Thinking Test Form X (CT) (Ennis & Millman, 1961) total
- Induction (IND) subtest
- Reliability (REL) subtest
- Deduction (DED) subtest
- Finding Assumptions (FIND ASSUMP) subtest

California Test of Mental Maturity (CTMM) (Calif. Test Bureau, 1964) total
- Language (LANG) subtest
- Non-Language (NON-LANG) subtest

Metropolitan Achievement Tests (METRO) (Durost, et al., 1959)
- Word Knowledge (WORD) subtest
- Reading (READ) subtest
- Spelling (SPELLING) subtest
- Language Study Skills (LANG SKILLS) subtest
- Arithmetic Computation (ARITH COMP) subtest
- Social Studies Study Skills (SS SKILLS) subtest

It was concluded therein that critical reading consists of a number of reading, thinking, and language activities, particularly vocabulary and also a number of hypothesized critical reading skills. It was also

concluded that critical reading involved some activities similar to critical thinking and some dissimilar activities.

The purpose of this analysis was to examine molecularly the definition of critical reading and also the relationship between critical reading and critical thinking found in the previous study.

Partial correlation was used to hold constant respectively intelligence, reading, and intelligence and reading combined. If moderate and/or strong correlations obtained after respectively intelligence and/or reading, or intelligence and reading combined, were removed, these correlations would be prima facie evidence for the existence of the construct of critical reading.

Canonical correlation was used to determine the maximum relationships between sets of subtests: literal reading subtests, critical reading subtests, critical thinking subtests, language and reading and achievement subtests, and combinations of these subtests. If high correlations obtained, these correlations would be prima facie evidence of large common variance, presumably language ability.

PROCEDURE

The subjects (Ss), typical Ballast Point Elementary School, Hillsborough County, Florida, fifth graders, were tested in the fall of 1969. The Ss were predominately lower and middle class, white children.

Partial correlation, second order partial correlation, multiple regression and part correlation, and canonical correlation were used to determine the relationships between various combinations of subtests.

The METRO and CTMM subtest scores were stanines not raw scores.

RESULTS

Table 1 indicates the first order partial correlations (and zero order correlations) with respectively CTMM LANG, CTMM total, and METRO READ partialled out, and the second order partial correlations with respectively CTMM LANG and METRO READ together, and CTMM total and METRO READ together, partialled out (N = 38).

CR SCI and CR SS correlated .54 with CTMM LANG partialled out, .51 with CTMM total removed, and .45 with METRO READ removed. Thus approximately 25% of the variance of CR SCI and CR SS is joint. This is a considerable amount of common variance and evidence for the existence of the construct of critical reading.

CR SS correlated .46 with CT with CTMM LANG partialled out and .42 with CT with CTMM total removed. This was slightly higher than CR SCI correlated with CT, .36 with CTMM LANG partialled out, and .32 with CTMM total removed. It was expected that both CR SCI and CR SS would correlate lower with CTMM LANG removed than with CTMM total removed because the removal of the language components only, rather than both language and non-language components, presumably would take out much variance, language variance, common to both CR SCI and CR SS and thus lower their correlation. That this did not occur is difficult to account for and may reflect in part some idiosyncratic aspects of CTMM.

The first order partials with METRO READ removed paralleled the other first order partials with CTMM LANG, and CTMM total taken out except that CR SCI and CT, and CR SS and CT, with METRO READ removed correlated much lower than when CTMM LANG, and CTMM total respectively, were removed. These lower correlations suggest that much of the

Table 1

First and Second Order Partial Correlations

	Correlates	(Zero Order Correlations)	Partialled Variable(s)	Partial Correlation
	CR SCI, CR SS	(.70)	CTMM LANG	.54*
	CR SCI, CT	(.55)	CTMM LANG	.36*
	CR SS, CT	(.60)	CTMM LANG	.46*
FIRST	CR SCI, CR SS	(.70)	CTMM	.51*
ORDER	CR SCI, CT	(.55)	CTMM	.32*
	CR SS, CT	(.60)	CTMM	.42*
	CR SCI, CR SS	(.70)	METRO READ	.45*
	CR SCI, CT	(.55)	METRO READ	.15
	CR SS, CT	(.60)	METRO READ	.20
	CR SCI, CR SS		CTMM LANG, METRO READ	.33*
	CR SCI, CR SS		CTMM, METRO READ	.30*
SECOND	CR SCI, CT		CTMM LANG, METRO READ	.09
ORDER	CR SCI, CT		CTMM, METRO READ	.06
	CR SS, CT		CTMM LANG, METRO READ	.13
	CR SS, CT		CTMM, METRO READ	.08

*Significant at the .01 level

critical thinking test variance is accounted for by the reading test variance. CR SCI correlated substantially and significantly, .45, with CR SS, with METRO READ removed, indicating considerable common non-reading variance. Again CR SCI correlated lower with CT than did CR SS as was anticipated.

The first order partial correlations are thus prima facie evidence for the existence of the construct of critical reading, and also for the assertion that much of the critical thinking variance is associated with reading ability.

In order that more precise inferences could be made about the respective influences of verbal intelligence test variance, critical reading test variance, and critical thinking test variance, multiple regression equations and part correlations (Pugh, 1968) were determined, specifically the unique and joint contributions of CR SS and CTMM LANG to CR SCI, CR SCI and CTMM LANG to CR SS, CR SCI and CR SS to CT, and CR SCI and CR SS to CTMM LANG. Of the 46% of the total variance that can be explained from the multiple regression coefficient of .68 for CR SCI considering the influences of CR SS and CTMM LANG, 19% was unique to CR SS, 3% was unique to CTMM LANG and 24% was joint variance of CR SS and CTMM LANG. Of the 49% of the total variance that can be explained from the multiple regression coefficient of .70 for CR SS considering the influences of CR SCI and CTMM LANG, 19% was unique to CR SCI, 7% was unique to CTMM LANG and 23% was joint variance of CR SS and CTMM LANG. Of the 31% of the total variance that can be explained from the multiple regression coefficient of .56 for CT considering the influences of CR SCI and CR SS, 2% was unique to CR SCI, 11% was unique

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to CR SS and 18% was joint variance of CR SCI and CR SS. Of the 35% of the total variance that can be explained from the multiple regression coefficient of .59 for CTMM LANG considering the influences of CR SCI and CR SS, 4% was unique to CR SCI, 8% was unique to CR SS, and 23% was joint variance of CR SCI and CR SS. It is apparent from these part correlations that CR SCI and CR SS share considerable common variance, that relatively little CR SCI and/or CR SS variance is uniquely accounted for by CTMM LANG although there is considerable common variance among CR SCI, CR SS, and CTMM LANG. Concurrently little CTMM LANG variance is accounted for uniquely by either CR SCI or CR SS. Some 11% of CT is uniquely accounted for by CR SS while only 2% of CT is uniquely accounted for by CR SCI. This low amount of variance uniquely accounted for by CR SCI probably reflects the low reliability (Odd-Even = .29, Kuder-Richardson = .24) found for the literal reading subtest items of CR SCI. Thus there is much joint variance between the two critical reading tests, less joint variance among the two critical reading and critical thinking tests, and more variance joint to the two critical reading and the verbal tests.

The second order partial correlations indicate findings similar to those of the first order partials. The two correlations between CR SCI and CR SS, with CTMM LANG and METRO READ, and CTMM total and METRO READ, respectively, partialled out were near .30 and significant. These correlations while lower than the first order partials with intelligence and reading ability removed separately, were similar and are high enough to represent limited evidence for the existence of the construct of critical reading. This inference is made because the two correlations respectively reflect nine percent and eleven percent of common variance

between the two critical reading tests. While this is not a large amount of variance, when it is considered with the common verbal intelligence, and total intelligence, and reading ability variance, it may be a useful amount particularly since it, together with verbal intelligence, total intelligence, and reading ability, accounts for nearly all of the two critical reading tests' variance. The highest of the four correlations in which both CT and METRO READ were included was .13. This indicates, as did the first order partials, that when the reading variance is removed from critical thinking, very little variance remains, regardless of whether critical thinking is correlated with critical reading, verbal intelligence, or total intelligence.

Thus the two main second order partial correlation findings are limited evidence for the existence of the construct of critical reading and also for the assertion that critical thinking, as measured by CT, has little unique variance, with much of its variance overlapping with reading variance.

Table 2 indicates the canonical correlation estimates of the maximum relation between the following sets of subtests: literal reading vs. critical thinking (1 vs. 2); literal reading vs. language and reading and achievement (1 vs. 5); critical reading vs. critical thinking (2 vs. 4); critical reading vs. language and reading and achievement (2 vs. 5); literal and critical reading vs. critical thinking (3 vs. 4); literal and critical reading vs. language and reading and achievement (3 vs. 5); and critical thinking vs. language and reading and achievement (4 vs. 5).

The canonical correlations were all moderately high or high, in excess of .62, indicating considerable overlap between the different sets of variables. The two critical reading subtests correlated .67 with

the four critical thinking subtests. The two literal and two critical reading subtests correlated .71 with the four critical thinking subtests. This is prima facie evidence of considerable common variance, ca. 47%, between critical reading and critical thinking. The two literal and the two critical reading subtests correlated .81 with the language and reading and achievement subtests. The four critical thinking subtests correlated .80 with them.

Table 2

Canonical Correlations

Set	Set	Canonical R
1	4	.63
1	5	.70
2	4	.67
2	5	.79
3	4	.71
3	5	.81
4	5	.80

Set 1	Set 2	Set 3	Set 4	Set 5
CR SCI LR	CR SCI CR	CR SCI LR	CT IND	CTMM LANG
CR SS LR	CR SS CR	CR SCI CR	CT REL	METRO WORD
		CR SS LR	CT DED	METRO READ
		CR SS CR	CT FIND ASSUMP	METRO LANG SKILLS
				METRO SS

The canonical correlations were corrected for attenuation to determine the maximum relationship between sets of subtests (Gulliksen, 1950). This correction implies, in effect, perfect reliability of both sets of subtests. When corrected, the correlation of .80 between the critical

reading subtests vs. the reading and language and achievement subtests, became .91. When corrected, the correlation of .81 between the critical thinking subtests vs. the reading and language and achievement subtests became .98. It is apparent that the reading and achievement subtests account for nearly all of the critical reading subtests' variance, and even more of the critical thinking subtests' variance. These two correlations reflect very strong overlap between both critical reading and reading and language achievement ability and also between critical thinking and reading and language and achievement ability. The overlap is so complete that reading and language achievement can be said to virtually account for critical reading and critical thinking.

CONCLUSIONS

1. Critical reading does not exist as a separate thinking activity.

2. Critical thinking also does not exist as a separate thinking activity.

3. Critical reading and critical thinking, in so far as they exist, share a considerable amount of common variance, verbal ability.

4. A final caveat, the validity of any correlational study depends upon the reliability and validity of the tests used.

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